Claims

1. A spectrometry instrument for measuring properties of a sample, comprising:

a microscope system having an illumination light path coupled to a light source and also having a collection light path coupled to a detector, the microscope system also including at least one microscope objective located in one or both of said illumination and collection light paths, one or more components of said microscope system inherently introducing polarization into said light paths,

said microscope system characterized by having at least one polarization-scrambling element located in at least one of said light paths between said polarization introducing components and a sample measuring position of said microscope system.

2. The instrument of claim 1 wherein the polarization-scrambling element is image-preserving.

3. The instrument of claim 2 wherein said polarization-scrambling element comprises a birefringent plate depolarizer of two or more plates.

4. The instrument of claim 3 wherein said birefringent plate depolarizer comprises a Lyot depolarizer.

5. The instrument of claim 3 wherein said birefringent plate depolarizer comprises a three-plate depolarizer.

6. The instrument of claim 1 further comprising a data processor for receiving measurement data from said spectrometer, said processor eliminating wavelength dependent perturbations in the measurement data that are due to said polarization-scrambling element.

7. The instrument of claim 1 wherein said detector in said collection light path is a spectrometer.

8. The instrument of claim 7 wherein said microscope system is a reflectometer, said collection light path being a reflected light path for light directed onto a sample and reflected therefrom.

9. The instrument of claim 8 wherein said reflectometer is arranged for normal incidence and reflection of light with a single microscope objective in both of said illumination and collection light paths, said components introducing said polarization including a beamsplitter separating said illumination and collection light paths.

10. The instrument of claim 8 wherein said reflectometer is arranged for non-normal incidence and reflection of light.

11. The instrument of claim 7 wherein said microscope system is a transmissive spectrophotometer with components of said microscope system for said illumination and collection light paths being located on opposite sides of a sample location.

12. The instrument of claim 1 wherein said light source comprises a monochromator.

13. The instrument of claim 1 wherein a sample placed in the sample measuring position of said microscope system affects the polarization state of collected light.

14. The instrument of claim 13 wherein the sample is birefringent.

15. The instrument of claim 13 wherein the sample includes a grating-like structure.

16. The instrument of claim 1 wherein the sample comprises a semiconductor wafer or photomask.

17. A reflectometry instrument for measuring properties of a sample, comprising:

a microscope reflectometer system having a microscope objective and with illumination and collection light paths passing through said microscope objective, one or more components of said microscope system inherently introducing polarization into said light paths, said microscope system characterized by having a polarization-scrambling element located in said light paths; and

a spectrometer receiving a portion of light collected by said microscope system.

18. The instrument of claim 17 wherein the polarization-scrambling element is image-preserving.

19. The instrument of claim 18 wherein said polarization-scrambling element comprises a birefringent plate depolarizer of two or more plates.

20. The instrument of claim 19 wherein said birefringent plate depolarizer comprises a Lyot depolarizer.

21. The instrument of claim 19 wherein said birefringent plate depolarizer comprises a three-plate depolarizer.

22. The instrument of claim 17 further comprising a data processor for receiving measurement data from said spectrometer, said processor eliminating wavelength dependent perturbations in the measurement data that are due to said polarization-scrambling element.

23. A depolarizer with more than two birefringent plates.

24. A depolarizer as in claim 23 where all the plates have substantially different thicknesses.

25. A depolarizer as in claim 23 where all the plates have substantially different rotation angles of their ordinary axis.

26. A depolarizer as in claim 23 with three plates.

27. A depolarizer as in claim 26 where the thicknesses of the plates are in some permutation of the ratios of 1:3:9.

28. A depolarizer as in claim 26 where the thicknesses of the plates are in some permutation of the ratios of 3:4:9.

29. A depolarizer as in claim 26 where the angle between two of the plates is substantially $n\frac{\pi}{2} \pm \arccos(-1/3)/4$, where n is an integer.

30. A depolarizer as in claim 26 where the angle between two of the plates is substantially $\left(n+\frac{1}{2}\right)\frac{\pi}{2}$ where n is an integer.

31. A depolarizer with 3 plates, where the thicknesses of the plates are selected so that the fundamental retardance frequency is not significantly detectable, and where all the plates have substantially different rotation angles of their ordinary axis.

32. An optical instrument for inspecting a sample, the instrument having illumination and collection optics with orthogonal linear polarization modes defining an instrument polarization axis, the optics including therein a depolarizer with two or more plates, the depolarizer plate furthest from the sample having its polarization axis rotationally aligned to the instrument's polarization axis, wherein the order of the plate thicknesses and angles is selected to eliminate at least the lowest retardance frequency in the detected signal.